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DRAWINGS ATTACHED

1 322 232

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(72) Inventor ANTHONY JOHN MARTIN

(54) SAFETY STEERING COLUMN ASSEMBLY

(71) We, FORD MOTOR COMPANY LIMITED, of 88 Regent Street, London, W.1, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to motor vehicle safety steering assemblies of the kind in which the steering wheel is supported by a structure arranged to collapse with absorption of energy if the driver of the vehicle is thrown against the steering wheel during a collision. The impact of the driver against the steering wheel in such circumstances is referred to as the secondary collision.

Energy absorbing structures for use in steering assemblies are now well known and extensively used. One of the more effective arrangements comprises an axially collapsible steering shaft within a coaxial column or tube. The column or tube is formed with corrugations and/or apertures such that the column collapses axially with plastic deformation and absorption of energy of the secondary collision.

According to the invention a motor vehicle has the following features:—

(a) clutch and brake pedals depend from a bearing in a pedal support structure;

(b) the forward end of the pedal support structure is fixed to a body structure of the vehicle;

(c) a collapsible steering shaft extends through the pedal support structure;

(d) a steering wheel is fixed to the steering shaft; and

(e) the pedal support structure is such that when the impact force of a driver of the vehicle against the steering wheel exceeds a certain value plastic deformation and collapse of the pedal support structure takes place and at least part of the energy of such impact is absorbed in the pedal support structure.

According to a further aspect of the invention a motor vehicle has the following features:—

(a) a combined pedal and steering shaft support structure is fixed at its forward end to a body structure of the vehicle;

(b) brake and clutch pedals are mounted in a forward section of the support structure;

(c) a steering shaft is supported by a rearward portion of the support structure;

(d) a steering wheel is fixed to the steering shaft; and

(e) the intermediate portion of the support structure is arranged to collapse and deform in the event that the impact force of a driver of the vehicle with the steering wheel exceeds a certain value and to absorb energy of such impact.

The invention will now be described with reference to the accompanying drawings in which:—

Figure 1 is a perspective view of a pedal box structure for use in a steering column assembly embodying the invention;

Figure 2 is a perspective view of a steering wheel and upper steering shaft for use with the pedal box structure of Figure 1;

Figure 3 is a perspective view of a preferred embodiment of the invention;

Figure 4 is a side view of the extended pedal box structure of the embodiment shown in Figure 3; and

Figures 5 and 6 are perspective views showing alternative constructions for the collapsible section of the pedal box structure in the embodiment of Figure 3.

Figures 1 and 2 show a simple embodiment of the invention. A pedal box structure 10 is fixed by flanges 11 to the lower dash panel of a motor vehicle body structure. Clutch and brake pedals (not shown) depend from a pedal bearing which extends through apertures 12 in the pedal box structure.

An upper steering shaft 13 fixed to a steering wheel 14 extends through an aperture 15 in a rear wall 16 of the pedal box structure 10. An impact disc 17 is fixed to the upper steering shaft and is located behind the pedal box structure 10 close to the rear wall 16 when the pedal box structure and upper shaft are in assembled relationship.

A lower steering shaft connects the upper steering shaft to a steering box. The upper and lower steering shafts together form an axially collapsible assembly. Such axial collapse may be achieved by using a rigid lower shaft connected to the upper shaft by shear pins or by using a flexible cable for the lower shaft.

The upper end of the upper shaft is supported by a bracket (not shown) secured beneath the upper dash panel of the vehicle body structure.

In the event of a collision, an impact force of the driver against the steering wheel exceeding a certain value forces the impact disc 17 against the pedal box structure which collapses with plastic deformation of the material and absorption of the energy of impact.

In the embodiment of Figure 3 a combined pedal and steering shaft support structure 20 comprises a base section 21, a corrugated collapsible intermediate section 22 and a steering shaft support section 23. The base section 21 is of inverted channel shape with substantially flat walls and carries a pedal shaft 24 from which brake and clutch pedals 25 and 26 depend. Flanges 27 are formed at the forward edges of the base section 21 for fixing the structure 20 to a front bulkhead 28 of a vehicle body structure as shown in Figure 4.

The steering shaft support section 23 is a reinforced box structure within which is fixed an upper steering shaft bearing (not shown). A breakaway bracket 29 is fixed to the steering shaft support section 23 and secures it to an upper dash panel of the vehicle body structure. The breakaway bracket is designed to yield at a predetermined force to allow the steering column assembly to collapse. A suitable bracket is described for example in our copending Application No. 3231/70 (Serial No. 1,241,148).

The steering shaft support section 23 may also house a direction indicator switch and an ignition switch and steering column lock.

A collapsible steering shaft 30 is mounted at its upper end in the bearing within the steering shaft support section 23 and extends forwardly within the combined pedal and steering shaft support structure 20 to a steering gear (not shown). The steering shaft may be a telescopic or collapsible assembly of rigid upper and lower sections or a flexible cable may be used for the lower part of the shaft. A steering wheel 31 is fixed to the steering shaft.

The intermediate section of the combined pedal and steering shaft support structure 20 is designed to collapse substantially uniformly under impact. Our preferred construction illustrated in Figure 5 is formed by pressing sheet metal into an inverted channel section with transverse corrugations. The inner corrugations are pierced or apertured at the corners of the channel to weaken the corners so that during collapse of the structure no undesirable skew forces are produced. It will be appreciated that in the absence of such weakening, the corners would have a greater resistance to collapse than the side walls and the steering wheel and steering shaft support section 23 would be displaced downwardly from the optimum direction of movement.

The design details including overall dimensions, pitch of the corrugations, material specification, and gauge of material of an intermediate section 22 which will collapse at a predetermined load when manufactured in large quantities can be found by extensive testing and development. It is an inherent advantage of this construction that wide variation of these design parameters is possible in order to achieve particular required characteristics of resistance to collapse. The response of the structure when impact of the driver against the steering wheel is inclined to the axis of the steering shaft can also be controlled by selection of the design parameters.

The base section 21, the intermediate section 22 and at least part of the steering shaft support section are preferbaly made by pressing from a single sheet of metal, but the structure may alternatively be fabricated from a number of separate parts welded together. Figure 6 illustrates a fabricated intermediate section 22 in which separate corrugated side walls 31 and top wall 32 are tack welded together to form an inverted channel section.

The embodiment of Figures 3 to 6 also forms the subject of our copending Application No. 2931/72 (Serial No. 1,322,233).

WHAT WE CLAIM IS:—

1. A motor vehicle in which:—

(a) clutch and brake pedals depend from a bearing in a pedal support structure;

(b) the forward end of the pedal support structure is fixed to a body structure of the vehicle;

(c) a collapsible steering shaft extends through the pedal support structure;

(d) a steering wheel is fixed to the steering shaft; and

(e) the pedal support structure is such that when the impact force of a driver of the vehicle against the steering wheel exceeds a certain value plastic deformation and collapse of the pedal support structure takes place and at least part of the energy of such impact is absorbed in the pedal support structure.

2. A motor vehicle in which:—

(a) a combined pedal and steering shaft

support structure is fixed at its forward end to a body structure of the vehicle;

(b) brake and clutch pedals are mounted in a forward section of the support structure;

(c) a steering shaft is supoprted by a rearward portion of the support structure;

(d) a steering wheel is fixed to the steering shaft; and

(e) the intermediate portion of the support structure is arranged to collapse and deform in the event that the impact force of a driver of the vehicle with the steering wheel exceeds a certain value and to absorb energy of such impact.

3. A vehicle as claimed in claim 2 in which the rearward section of the support structure is connected to the vehicle body structure by a breakaway bracket.

4. A vehicle as claimed in claim 2 or claim 3 in which the intermediate portion of the support structure is formed of sheet metal and is of inverted channel section with corrugations which extend transversely of the steering shaft.

5. A motor vehicle having a steering column assembly substantially as hereinbefore described with reference to Figures 1 and 2 of the accompanying drawings.

6. A motor vehicle having a steering column assembly substantially as hereinbefore described with reference to and as shown in Figures 3 to 6 of the accompanying drawings.

PETER ORTON,
Chartered Patent Agent.

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Sheet 1

FIG.1

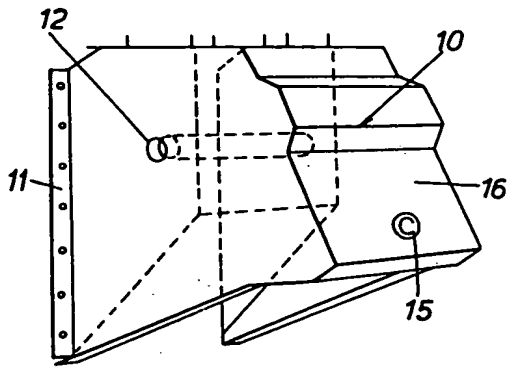
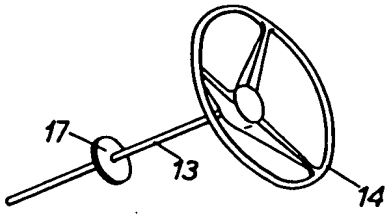


FIG.2.



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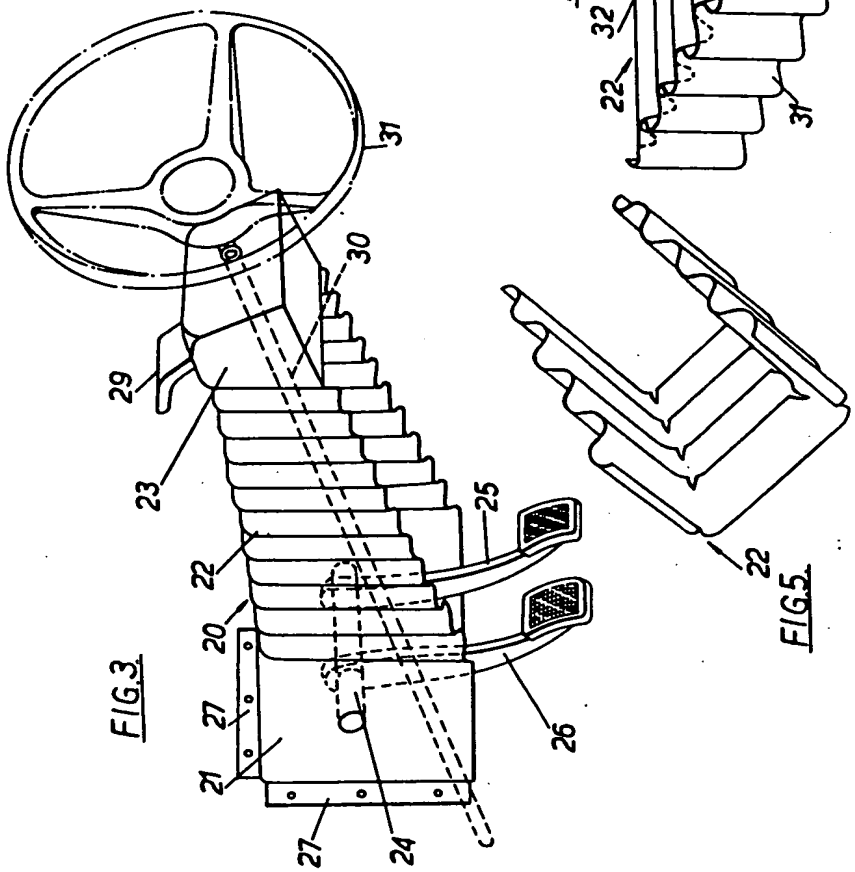

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FIG.4